

gauge axes. The barbs then, are parallel with these axes. The gauge pointer can be set for any point along the axis of a barb as in the measurement of barb distances it was set at required points along the rhachis. Measurements are made progressively from apex of barb through all intervening pattern loci to junction of barb and rhachis. The stage carrying the feather is free to move in the line of the rhachis; any barb on the rhachis can be set under the pointer of the measuring gauge.

Measurement of barb frequency, barb length, and length of pattern segment with these methods becomes a relatively simple operation. A very high degree of accuracy is easily attained. Barbule frequencies and barbule lengths have been determined in some instances, although not to the degree of accuracy possible in the determination of barb and rhachis characteristics.

Determination of barb frequencies in various feathers points to a characteristic form of curve in the several feather tracts. Curves for breast differ greatly from curves for saddle and back. Some evidence is at hand indicating orderly relations of barb frequency to asymmetries of feather and tract. These general relations will be reported in detail elsewhere.

7495 P

Pattern Analysis in Plumage. III. Action of Thyroxin in High Concentrations.

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The sequence of response of the components of the definitive feather to increasing thyroxin concentrations—blanching of barbs, barbule formation, and pigment deposition—and the manner of estimating barb growth in the germ by observation of the order of appearance of pigment following injection of thyroxin have been established by Lillie and Juhn.¹

An examination of definitive feathers subjected to heavy thyroxin dosages (10 mg., single injection) during development shows that both barb frequency and barb lengths are markedly altered. Barb frequency increases to a level around twice the barb frequency of a normal feather; a sudden drop then occurs to a level below that

¹ Lillie, Frank R., and Juhn, Mary, *Physiol. Zool.*, 1932, 5, 124.

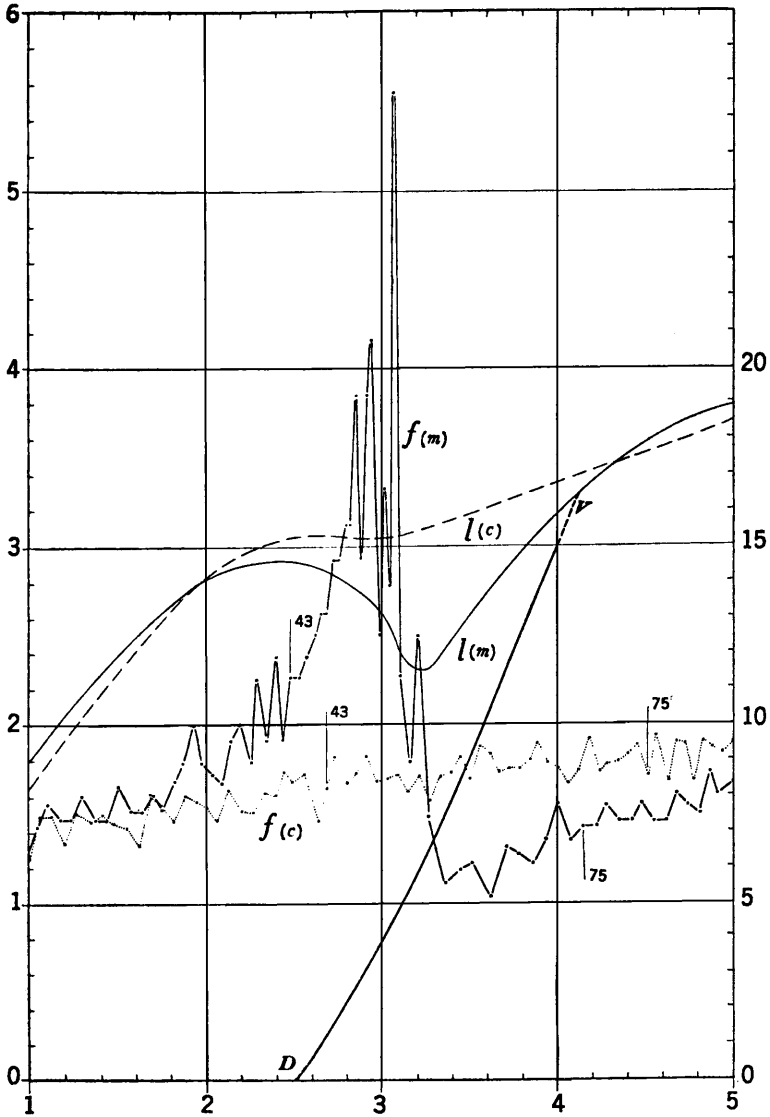


FIG. 1.

characteristic of barb frequency for the same region of the control feather. Barb length decreases following injection of thyroxin, then gradually returns to normal or possibly greater than normal length.

These relations are shown in the accompanying graph. The curves are for single longitudinal vane-halves of modified and control neck feathers. Distances from origin of rachis are given in

centimeters on the horizontal axis. Figures on the left ordinate refer to barb frequency, *i. e.*, the number of barbs per millimeter rhachis length. Figures on the right ordinate apply to barb lengths.

Barb frequency of the control and modified feathers are given by the curves $f_{(c)}$ and $f_{(m)}$ respectively. Curves $l_{(c)}$ and $l_{(m)}$ are contour lines of the control and modified vane margins respectively. The length of barb at any point on the rhachis is the distance from the contour line to the base of the figure.

The diagonal line, D-V, is the line of pigment deposition; the segment of barb lying between D-V and the contour line $l_{(m)}$, is the length of barb above the collar at the time of pigment deposition. Lengths between D-V and the rhachis (abscissa) are barb segments laid down following pigment determination in the collar.

The numbers "43" and "75" refer to identical barbs on the modified and control rhachises. The region of pigment deposition extends from barb 43 to barb 75. Due to the modified barb distribution along the rhachis of the feather treated with thyroxin, these and all intervening barbs—which in at least this number were in the collar at the time of thyroxin injection—must be compared with corresponding barb number in the control feather.

Both barb frequency and barb length are modified by thyroxin over a considerable range anterior to the first barb showing pigment deposition. This effect is possibly due either to failure of thyroxin to effect melanin deposition in all barbs in the zone of determination, or to interference with the normal expansion (ballooning) of barbs and rhachis after they have passed beyond the zone of determination.

The significance of these results in relation to events in the germ will be taken up in a forthcoming paper; at that time we shall consider also the action of thyroxin over a wide range of concentrations.

7496 P

Pattern Analysis in Plumage. IV. Order of Asymmetry in the Breast Tracts.

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In experiments with female hormone in this laboratory it was found that when the mark due to the hormone was restricted to one vane-half in the definitive breast feather, other feathers were occa-